CHAPTER 5

Catastrophe Risk Insurance

Insurance plays a vital role in America's economy by helping households and businesses manage risks. Individuals purchase insurance so they can sleep well at night; they gain comfort from the knowledge that they and their families are protected from some of the adverse effects of future events beyond their control. Businesses purchase insurance for much the same reason. It allows them to reduce the uncertainty associated with future costs and revenues, which enables them to plan for the future more effectively. Today, one can purchase insurance protection against a myriad of economic hazards, from poor health to motor vehicle accidents to legal liability to lightning strikes.

Insuring economic losses arising from large-scale natural and manmade catastrophes such as earthquakes, hurricanes, and terrorist attacks poses special challenges for the insurance industry and for Federal and State governments. This chapter examines the economics of catastrophe risk insurance. It draws the following main conclusions.

- In insurance markets, as in other markets, prices affect the way people weigh costs and benefits. Insurance prices that are artificially low can discourage people from adequately protecting against future losses. For example, subsidized property insurance prices may stimulate excessive building in high-risk areas, potentially driving up future government disaster relief spending.
- Government intervention in insurance markets can have unintended consequences such as limiting the availability of insurance offered by private firms.
- Private insurers manage catastrophe losses by being selective about which risks to insure, by designing insurance contracts to provide incentives for risk-reducing behavior, and by charging prices that are high enough to enable them to diversify risk over time or transfer risk to third parties. By adopting private sector risk management and pricing practices, government insurance programs could reduce the burden they impose on taxpayers and minimize negative effects on private insurance markets.

The Economics of Catastrophe Risk Insurance

In the United States, insurance is provided through a variety of private and public entities. Insurance companies owned by investors or policyholders sell insurance in the private sector. State-sponsored insurance pools have

characteristics of both private and public entities. They are typically owned by a group of private insurers, but they are governed under charters that grant them special rights and impose responsibilities not required of private insurers. Finally, the Federal Government operates at least 135 different programs that provide insurance-like benefits to individuals and businesses.

To understand how insurance works, imagine a large group of homeowners scattered throughout the country, each of whom faces a risk of property damage from a variety of identified hazards such as fire or severe weather. The likelihood that any particular member of the group will experience a loss is low, but the economic costs to that individual, should a loss occur, are significant. Each member of the group can reduce uncertainty about future economic losses by agreeing to pool risk with other members. One way of accomplishing this is through a mutual insurance agreement. At the beginning of the year, each member agrees to make a payment, called an *insurance premium,* into the pool. In exchange for their premiums, members are allowed to file claims with the pool should their houses incur damage from a covered hazard. Even if the insurance pool has no other resources, as long as the total value of premiums paid into the pool is at least as large as the value of insured losses over the year, all property damage will be fully covered. In this way, members of the pool gain security through diversification. Because any member's losses are paid for with premiums collected by all members, no member faces uncertainty about how much he will have to pay to cover property damage in the coming year.

The process of evaluating a risk exposure, determining whether or not to insure it, and setting terms and conditions for any insurance provided is called *underwriting*. Through underwriting, insurance providers seek to tie the premiums charged for insurance policies to the risks those policies cover. Effective underwriting serves an important social function, because when insurance prices accurately reflect underlying economic costs they can encourage a more efficient allocation of scarce resources. For example, suppose a member of a coastal community must decide where to build a new home. She may prefer to live as close to the ocean as possible, but a home located nearer the ocean may be exposed to a higher risk of damage from windstorms and flooding. If homeowners' insurance premiums are appropriately risk sensitive, then she will need to determine whether the benefits of living closer to the ocean are worth the cost of higher insurance premiums.

Underwriting is critical to the efficient functioning of insurance markets. In general, insurance markets function best under the following conditions:

1. Either all members of a pool face similar risks, or differences in risks can be observed and incorporated in insurance premiums.
2. Insurance does not dissuade those who are insured from avoiding risks.
3. The total value of insured losses for a pool can be forecast with precision.

In many insurance markets, one or both of the first two conditions may not hold. Violations of the third condition are a particular feature of catastrophe-risk insurance markets. Through effective underwriting, insurers can reduce, though perhaps not eliminate, problems that arise when these conditions fail to hold.

Effective Underwriting Reduces Information Problems

Insurance markets may fail to work effectively when differences in the risks faced by policyholders cannot be incorporated in insurance premiums. To see why, consider again the example of homeowners pooling risk. Suppose now that there are two types of homeowners: those who live in coastal areas that are at relatively high risk for windstorms and floods, and those who live in inland areas at lower risk for these hazards. If all homeowners were charged the same insurance premium, and if premiums were set equal to the average loss rate for all homes, then homeowners in inland regions would rightly feel that they were being overcharged. They face less risk from windstorms and floods than owners in coastal regions, yet they are asked to pay a premium equal to average losses for a pool that includes houses in both regions. Owners living in coastal areas would be attracted to the pool because it offers insurance at a premium that does not reflect their homes' higher risk. If the insurance policy were offered to all homeowners, a disproportionate share of those in coastal regions would accept the policy, while a disproportionate share of those living inland would seek insurance elsewhere or would choose to go without insurance. As a result, the average loss for those who chose to participate in the pool would be higher than the premium charged.

This example illustrates a general property of insurance contracts which economists call *adverse selection*. When premiums do not reflect differences in risk that are known to potential policyholders, insurance pools tend to attract members who are at greatest risk for the hazards covered. The solution to this problem is to charge policyholders with different risk exposures different premiums. In the example above, adverse selection could be avoided if homeowners in inland areas were charged lower premiums than those in coastal regions. Insurance providers generally try to set premiums commensurate with risk, but this is not always possible. In some cases it may simply be too costly for an insurance provider to identify differences in risk, but, as discussed later in this chapter, efforts by policymakers and insurance regulators to keep premiums for some high-risk policyholders low can also play a role.

Inefficiencies can also arise when insurance discourages those who are insured from taking actions to reduce potential losses. Consider the incentives faced by a homeowner thinking about how best to prepare for future windstorms. Many homeowners can reduce the damage caused by windstorms by installing storm shutters, but storm shutters are costly. If a homeowner is fully insured against the economic losses arising from future windstorms, she may

be less likely to purchase shutters. The tendency of those who are insured to work less hard to avoid losses is called *moral hazard*.

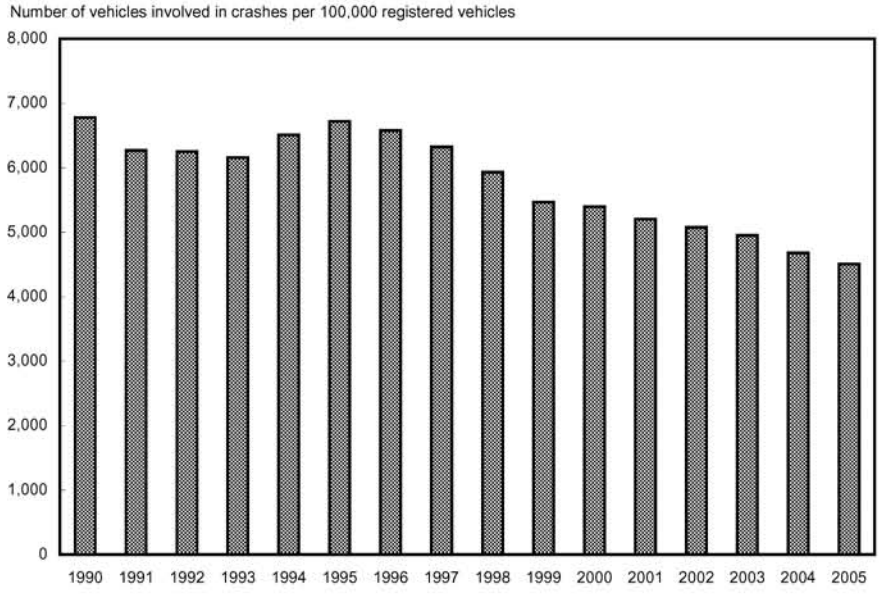
Insurance providers are well aware of the potential for moral hazard, and they attempt to address it through effective underwriting. Many insurance policies only cover losses in excess of a specified amount called a *deductible*, or they require that policyholders pay a fixed share of any losses incurred. By insuring some, but not all, economic losses, these types of policies strengthen policyholders' incentives to work to reduce the risks they face. Insurers may also require that specific action be taken as a precondition for receiving coverage, or they might provide pricing incentives for risk-reducing investments. For example, an insurer might refuse to cover windstorm risks for homes without storm shutters, or it might charge those homeowners a higher premium.

Catastrophe Losses Are Difficult to Forecast

Adverse selection and moral hazard problems are common in many insurance markets. Catastrophe risk insurers face an additional challenge, which arises from the fact that the total value of losses for a pool of insured properties or individuals is often exceptionally difficult to predict.

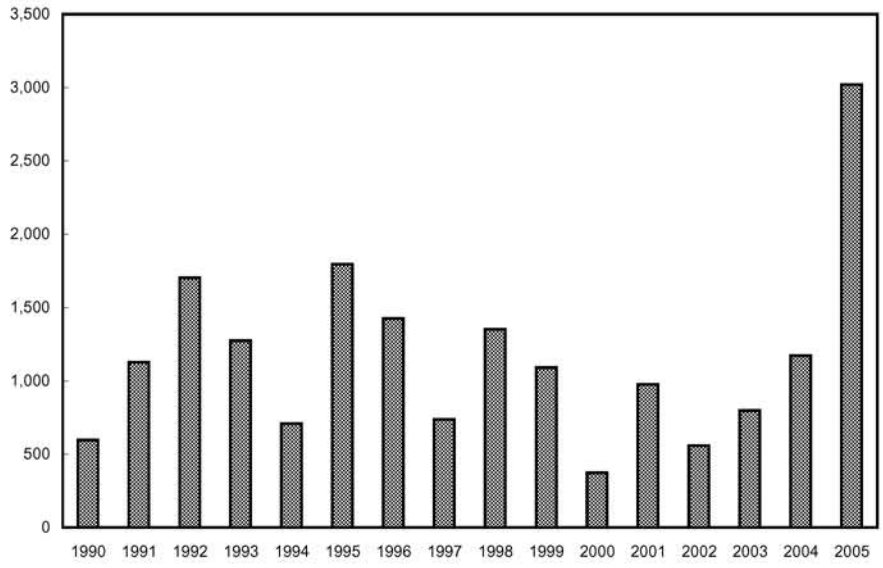
Forecasting annual losses from hazards like automobile accidents that only affect one or two members of a pool at a time is much easier than forecasting losses from large-scale catastrophes such as floods, hurricanes, or terrorist attacks. When the losses incurred by individual members of an insurance pool are more or less independent of one another, the average loss rate per policy is likely to be stable over time. Chart 5-1 illustrates this point by showing the annual nationwide accident rate per 100,000 registered passenger cars. While the accident rate has gradually declined over the past 15 years, it changes relatively little from year to year. It is difficult to predict whether any particular vehicle will be involved in an accident, but based on the data presented we can forecast with high confidence that about 4.5 percent of all passenger cars will be involved in some kind of accident over the next year. Because large-scale catastrophes have the potential to affect many members of an insurance pool simultaneously, spreading risk across a large number of members may not be sufficient to ensure that average losses per policy are stable over time. Compare Chart 5-1 with Chart 5-2. Chart 5-2 reports the number of loss claims filed per 100,000 homes and businesses insured for flood losses under the Federal Emergency Management Agency's National Flood Insurance Program (NFIP). Flood losses are not independent of one another; a single flood event can damage hundreds or even thousands of properties. Even though the NFIP insures a pool of millions of properties, the average loss rate per policy varies considerably from year to year.

Chart 5-1 **Annual Accident Rate for U.S. Passenger Cars**
Automobile accident rates have fallen over time, but change relatively little from year to year.



Source: National Highway Traffic Safety Administration.

Chart 5-2 **Annual Claim Rate for Properties Covered by the National Flood Insurance Program**
Flood-loss claim rates vary considerably from year to year.



Source: Federal Emergency Management Agency.

In some catastrophe-risk insurance markets, forecast accuracy also suffers from a lack of relevant historical data and experience. This is a particular problem when catastrophes are rare, and when the character of those events is likely to change over time. For example, U.S. commercial property and casualty insurers had almost no experience forecasting losses from large-scale terrorist attacks prior to September 11, 2001. A recent report by the President's Working Group on Financial Markets on the availability and affordability of insurance for terrorism risk found that while modeling of terrorism risk has improved since 2001, insurers continue to have limited confidence in the models they use for evaluating this risk exposure.

When annual losses for a pool can be forecast with reasonably high precision, it is relatively easy for an insurance provider to manage risk. As long as its underwriting procedures ensure that the average premium paid by members of the pool is at least as large as the average loss rate per member, it is likely that in any given year total premium revenues for the pool will be sufficient to pay all claims. If, as in our automobile accident example, losses are independent across members of a pool, increasing the size of the pool actually makes it easier for an insurer to manage risk, because the more members that are included in the pool, the more stable will be the average loss rate per member.

Losses from catastrophes are not independent across exposures, and therefore they are much more difficult to manage. A severe hurricane, for example, can cause damage over tens of thousands of square miles, so even if an insurer provides windstorm coverage for properties scattered throughout a state, average losses per property are likely to be exceptionally high in hurricane years. Since catastrophes are infrequent but costly, annual premium revenues for a pool of exposures that exceed the value of claims in most years may not be sufficient to pay all claims in those rare years when a severe event occurs. Insurance providers work to address this problem by pooling risk across time or by diversifying the risk exposure more broadly by sharing it with other insurers.

Managing Catastrophe Losses

One way to manage the financial risk of insuring catastrophe hazards is to retain a portion of excess premium revenues collected in years when losses are low to pay claims in years when catastrophes generate large losses. Equity capital set aside to pay potential claims is called *surplus*. In practice, building surplus large enough to pay catastrophe losses can be difficult for private insurance companies. Owners of insurance companies expect to earn a market rate of return on their equity investments, including equity held as surplus to cover future claims. Moreover, income flowing from insurance company assets is subject to corporate income tax that effectively adds to the cost of accumulating and holding surplus.

An alternative to using surplus to cover catastrophe losses is to transfer risk to third parties. Some insurers transfer risk directly to capital market participants such as hedge funds and institutional investors (Box 5-1). More commonly, insurers negotiate risk-sharing agreements with specialized insurance companies called *reinsurers*. Reinsurers are internationally diversified companies that make a business of selling insurance to primary insurers. In a typical reinsurance arrangement, a primary insurer pays a fee to a reinsurance company that agrees to cover some of the insurer's costs in the event that claims exceed a prespecified threshold. In essence, reinsurance arrangements work much like other types of insurance. Through reinsurance a primary insurer subject to the risk of high claims caused by a catastrophe can pool its risk with other primary insurers that are exposed to different hazards. As with other types of insurance, problems of adverse selection and moral hazard can impede the efficient functioning of reinsurance markets.

Box 5-1: Catastrophe Bonds and Sidecars—Accessing Financial Markets to Better Manage Catastrophe Risks

Though reinsurance agreements between primary insurers and specialized reinsurance companies remain the most popular method for transferring and pooling risks posed by large-scale catastrophes, the capital available to reinsurers is only a tiny fraction of the total capital invested in financial markets. By one estimate, reinsurance companies worldwide had accumulated about $400 billion in shareholder funds by year-end 2005, which is only about 1 percent of the market capitalization of the world's public equity markets. To spread catastrophe risks more broadly, financial markets have developed mechanisms to allow investors who do not directly hold shares in insurance companies to assume some of the catastrophe risk exposure of primary insurers or reinsurers in exchange for an appropriate investment return. Two notable examples are catastrophe bonds and "sidecars."

Catastrophe bonds (CAT bonds), also called "acts of God" bonds, are risk-linked securities that offer a return to investors similar to that on high-yield corporate junk bonds. In a typical CAT bond transaction, a firm that wants to transfer some risk to outside investors issues a bond and invests the proceeds in safe securities. If a specified catastrophe event occurs, the proceeds from the bond issue are released to the issuer. If no event occurs during the term of the bond, the principal is returned to investors. Payouts from CAT bonds are often tied to industry-wide loss estimates or defined catastrophe events such as whether or not a hurricane makes landfall on a particular stretch of coastline. Because these types of events are presumably beyond the

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Box 5-1 — *continued*

control of the bond issuer, investors are protected from moral hazard. A drawback of these types of CAT bonds, however, is that they do not protect the issuer against all possible catastrophe losses. For example, an insurer that issues a bond with a payout tied to a hurricane event could be exposed to large losses from a tropical storm that does not meet the definition of a hurricane. The market for CAT bonds has grown rapidly over the past decade, though the value of bonds outstanding remains small relative to the value of insured losses in recent catastrophe events. About $4.9 billion in CAT bond capital was outstanding as of year-end 2005, a 21 percent increase over the 2004 level.

Sidecars provide an increasingly popular alternative to CAT bonds. A sidecar is a special-purpose financial entity, usually designed to last 2 to 3 years. Under a sidecar arrangement, a group of investors partners with an existing reinsurance company: the investors provide the necessary funds for deployment and the reinsurance company contributes its infrastructure, business relationships, and the skills of its staff. Sidecar investors receive a portion of the reinsurance company's premium revenue from a particular reinsurance contract or line of business, and the reinsurer gains access to the investors' capital to cover potential catastrophe losses. Through sidecars, investors can decide to assume particular catastrophe risks without being exposed to all of the risks covered by a given reinsurance company. Sidecars have helped Bermuda-based reinsurance companies to expand their capacity to cover catastrophe risk exposures in the United States despite incurring significant losses in 2005. About $2.5 billion in capital was reportedly raised through sidecars organized with Bermuda reinsurers from December 2005 to June 2006.

Through CAT bonds, sidecars, and other innovative financing mechanisms, insurers and private investors are finding new ways to spread the risks posed by large-scale catastrophes. These financing mechanisms currently contribute only a relatively small share of the total capital available to cover catastrophe losses, but the volume of capital they have raised has grown rapidly in recent years. It is likely that as these markets mature, the base of investors willing to bear some catastrophe risk will continue to expand, ultimately lowering the cost of insuring catastrophe risks.

What happens if an insurance provider lacks the resources to pay claims following a catastrophe? Private-sector insurance companies that cannot afford to pay claims are usually forced into receivership. In contrast, many government-sponsored insurers can raise additional funds to pay claims after an event has occurred. Government-sponsored insurance programs often do not face the same financial constraints as private insurers because they have special rights to compel third parties such as taxpayers or private insurers to bear a portion of their financial risk. The NFIP, for example, is authorized by Congress to borrow from the U.S. Treasury, which increases taxpayer liabilities, and the Federal Government's terrorism-risk insurance program and several State-sponsored catastrophe insurance providers are empowered to levy surcharges on policies sold by private insurers.

Federal Catastrophe Insurance Programs

In 1803, Congress passed a law granting the victims of a fire in Portsmouth, New Hampshire, extra time to repay certain debts owed to the Federal Government. Though the Federal Government has assisted Americans harmed by disasters throughout the Nation's history, prior to the mid-twentieth century aid was generally provided on an ad hoc basis; a disaster would strike and Congress would then determine whether and to what extent Federal aid would be provided. Acts of Congress passed in 1947 and 1950 regularized the process by which the Federal Government extends assistance to disaster-affected communities and additional legislation enacted since then has clarified and expanded the Government's role in disaster relief.

One problem with a variety of government relief efforts is that they can make it more difficult for private insurers to sell policies for some catastrophe hazards at prices commensurate with underlying risks. People have less incentive to pay sometimes high insurance premiums if they expect to receive aid from the government when a catastrophe strikes. Policymakers have sought to address this moral hazard problem in several different ways. The Federal Government provides insurance coverage for certain catastrophe hazards, often at prices lower than those that would be charged by private insurers. In addition, in some cases the Government requires that individuals purchase insurance policies or mandates that private insurers offer policies for sale.

The National Flood Insurance Program

The National Flood Insurance Program (NFIP) was established in 1968 to make flood insurance more widely available to homeowners and businesses, to encourage local communities to prepare better for flood hazards, and to reduce reliance on direct Federal disaster relief following floods. The NFIP

currently provides flood insurance for 5.3 million policyholders nationwide, many of whom might not be able to obtain coverage without the program. Residential and commercial property owners in some 20,000 participating communities are eligible to purchase flood insurance policies under the program. Homeowners with mortgages issued by federally regulated lenders on property in communities identified to be in flood hazard areas are required to purchase flood insurance on their dwellings. Property owners can purchase policies either directly from the Federal Government or, more commonly, through local insurance companies who sell NFIP policies under their own name but pass their risk on to the Government. Whether policies are sold directly by the Federal Government or by insurance companies, the NFIP receives premium payments for the policies and bears all financial risks associated with the insurance they provide. The program is administered by the Federal Emergency Management Agency (FEMA).

FEMA relies on Flood Insurance Rate Maps (FIRMs) when underwriting flood insurance. These maps identify areas within a community that have at least a 1-percent chance per year of being inundated by high water. These areas are called 100-year floodplains. Federal flood insurance is only made available in local communities that agree to adopt zoning ordinances, building codes, and other planning measures designed to reduce future damage caused by floods. For example, communities must require that new buildings be elevated above the level that flood waters are expected to reach on average once per 100 years. According to FEMA, buildings that meet its floodplain management standards suffer 80 percent less damage from floods each year than those that do not. Not all structures insured under the NFIP meet these standards, however; structures completed prior to a community's decision to participate in the program or prior to the publication of a community's FIRM are eligible for insurance under the program even if they do not meet FEMA standards.

The NFIP charges different premiums for different properties. A structure built or substantially renovated after 1974 or after a community's FIRM was completed (whichever is later) is charged an *actuarially fair* annual premium equal to an estimate of expected annual claims under the property's flood insurance policy. Policyholders who pay actuarially fair premiums year after year should, in the long run, end up paying premiums that are just sufficient to cover their claims on average. About one-quarter of NFIP policies cover properties built prior to 1974 or prior to the publication of a community's FIRM. By law, these "pre-FIRM" properties are charged subsidized premiums. Pre-FIRM properties are much less likely to comply with modern flood risk mitigation standards since most were built before such standards were widely applied. Because of their higher risk, pre-FIRM properties are assessed higher premiums on average than newer properties, but even these

higher premiums are not adequate to cover expected losses. On average, premiums for pre-FIRM properties represent only about 40 percent of those properties' actuarially fair rates.

Not surprisingly, the NFIP pricing scheme has led to serious adverse selection and moral hazard problems. On the one hand, FEMA estimates that one-half to two-thirds of structures in floodplains do not carry flood insurance. On the other hand, some exceptionally high-risk properties continue to receive NFIP coverage at subsidized rates even though they have been damaged by floods multiple times since entering the program. Some 50,644 properties insured by the NFIP as of September 30, 2004 had incurred flood damage resulting in claims of at least $1,000 more than once during a 10-year period. While these properties only represented about 1 percent of all structures then insured under the program, repetitive-loss properties have historically accounted for 38 percent of all program claims payments. Amendments to the Flood Insurance Act passed in 2004 authorized a pilot program to remove some of the most severe repetitive-loss properties from the NFIP insurance roll by allowing FEMA to fund work to elevate or relocate some of them or, in extreme cases, to purchase and demolish them.

The NFIP illustrates how underwriting standards can either enhance or impede loss mitigation. By providing coverage only in communities that agree to adopt flood-risk mitigation measures, the NFIP may have induced some communities to take steps that FEMA credits with reducing flood damage by an average $1.2 billion annually. At the same time, by providing insurance to pre-FIRM properties at less than actuarially fair rates, the program may have discouraged some policyholders from relocating or renovating structures at high risk for flood damage. The availability of flood insurance has lowered the risk to banks of financing real-estate investment in locations vulnerable to flood losses. As a result, it is not clear whether the NFIP has reduced the size of Federal appropriations for flood disaster relief as intended. Demand for Federal disaster aid may arguably be higher than it would have been had the NFIP not facilitated development in high-risk areas.

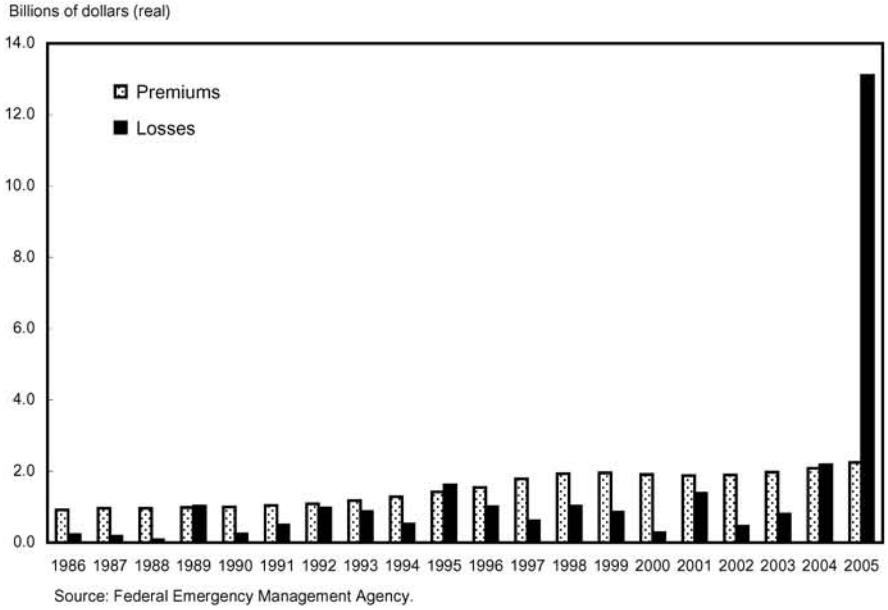
Chart 5-3 shows that since 1986 NFIP premiums exceeded annual losses in most years, but were woefully inadequate to cover losses from Hurricanes Katrina, Rita, and Wilma in 2005. The 2005 hurricanes resulted in about $16.3 billion in NFIP program claims, some of which were not paid until 2006. Even so, claims paid in 2005 exceeded premiums collected in that year by a factor of nearly six to one. Unlike private sector insurers, who would need to accumulate surplus or purchase reinsurance to pay claims in excess of premiums, the NFIP is permitted to borrow from the Federal Government. As of August 2005, just before Hurricane Katrina struck, the NFIP had accumulated a relatively modest $300 million in debt owed to the U.S. Treasury, but the program will need to borrow an additional $21.2 billion to pay claims

filed in 2005. Though the NFIP is supposed to repay this debt using future premium revenue, it is unlikely that this will be possible. The Congressional Budget Office estimates that by 2007 the interest on NFIP debt will grow to about $1 billion annually, which is about 40 percent of the projected annual premium revenue. Even if future hurricane seasons are milder than those experienced in recent years, projected premiums are not expected to be large enough to cover both the interest on the outstanding debt and the projected future claims. The NFIP's current dire financial situation amply demonstrates that in insurance, as elsewhere, there is no free lunch. Annual premium revenue from the NFIP was able to cover losses in most of the program's recent history, but the subsidized insurance program exposed the American taxpayers to a huge potential financial liability which became an actual liability in 2005.

Terrorism and War-Risk Insurance Programs

The Federal Government provided billions of dollars in disaster assistance following the September 11, 2001 terrorist attacks on New York and Washington, DC, including about $4 billion in aid to the airline industry and about $20 billion in aid to the New York City area. To date, about $36 billion

Chart 5-3 **National Flood Insurance Program Annual Premiums and Losses**
Annual premiums were sufficient to cover annual losses in most years, but were woefully inadequate in 2005.



Source: Federal Emergency Management Agency.

in loss claims have been paid by private insurers. Though insured losses represented only a fraction of the total economic costs of the September 11 attacks, they were far greater than those arising from any prior terrorist event.

Following September 11, commercial property and casualty insurers reevaluated their policyholders' exposure to risk from possible future attacks. Many insurers canceled policies, began explicitly excluding coverage for terrorist attacks from new policies, or increased premiums charged to policyholders. In response to what was believed to be a temporary contraction in the supply of insurance available for terrorism risk, the Administration and Congress undertook measures to ensure that the airline and commercial real estate sectors would not be adversely affected.

Less than two weeks after the September 11 attacks, the Federal Aviation Administration (FAA) began selling insurance policies directly to U.S. airlines to cover third-party liability (e.g., harm to individuals or property on the ground) arising from acts of war or terrorism, and in November of 2002 the Homeland Security Act expanded this program to provide insurance coverage for loss of aircraft and airline passenger liability as well. The program has been reauthorized several times since its inception and it remains in effect today. As of October 1, 2006, policies under this program provided 75 airlines with insurance coverage for potential losses ranging from $100 million to $4 billion each.

The Terrorism Risk Insurance Act (TRIA) passed in November of 2002 established a second, much broader, Federal program to encourage private-sector commercial property and casualty insurers to provide terrorism risk coverage. The program was originally designed to expire after three years, but in 2005 Congress elected to extend the program with some modifications through 2007.

TRIA has two main components. First, it mandates that insurance companies that sell commercial property and casualty insurance make available to customers policies that do not explicitly exclude coverage for losses caused by acts of terrorism. Insurers may exclude losses on other grounds, however, so not all losses arising from terrorist attacks must be covered. According to the President's Working Group on Financial Markets, commercial insurance policies generally do not cover losses arising from chemical, nuclear, biological, and radiological events, whether or not these events are caused by acts of terrorism. Second, TRIA authorizes the Treasury Department to provide reinsurance to cover a portion of insurance loss claims arising from certified acts of international terrorism against U.S. targets. Under the reinsurance program, a primary insurer must cover 100 percent of its loss claims up to a specified deductible. The Federal Government then pays a fixed share of losses in excess of the deductible. For 2007 an insurance company is required to cover all losses up to 20 percent of its prior year's premiums on qualifying

lines of business and 15 percent of losses above this deductible. TRIA imposes a cap of $100 billion on total insurer losses from terrorist attacks. Under the statute, Congress would determine the procedures to govern any payments for losses beyond $100 billion in separate legislation.

Since 2001, no claims have been filed under either the FAA's aviation war-risk insurance program or the Treasury Department's terrorism-risk reinsurance program, but, like the NFIP, both of these programs expose U.S. taxpayers to large potential losses. Because they were intended to be temporary, neither program is designed to ensure that premiums will be sufficient to pay future claims. Premium revenue collected under the aviation war-risk program is subject to a cap mandated by Congress. As a result, premiums charged by the FAA are significantly lower than those that would be charged for comparable policies sold by private-sector aviation insurers. Airlines pay a total of about $160 million in premiums to the FAA each year; by one estimate, without the program these airlines would need to pay $500 million annually in premiums to private insurers. TRIA does not require property and casualty insurers to pay *any* premiums for the reinsurance protection they receive. Instead, claims under the program are expected to be paid with Federal outlays and then recouped, after the fact, through surcharges levied on future premiums for property and casualty insurance policies. Given that the program was established in part to address problems arising from high insurance premiums following the September 11, 2001 attacks, there are real questions as to whether surcharges would be set high enough to recoup expenditures following a future terrorist attack. Any surcharges would likely be spread over several years to reduce the impact on premiums, and since the Treasury Department is only required by law to recoup up to $27.5 billion, there is no guarantee that the full costs of the program would ultimately be recovered.

State Property Insurance Markets

Although the Federal Government is actively involved in insuring risks from floods and terrorist attacks, most homeowners and businesses look first to their local property insurers to obtain financial protection against a variety of hazards including potential catastrophes. State governments are responsible for regulating insurance markets. Though laws differ from state to state, all states' insurance regulators exercise some control over who is permitted to sell insurance, what terms and conditions can be attached to insurance policies, and how much insurers can charge. Insurance regulations are intended to protect consumers who may have difficulty evaluating complex insurance contracts and to ensure that insurers maintain sufficient financial resources to pay future claims. While regulation plays an important role in protecting

consumers from fraud and poor risk management practices, poorly conceived and executed regulation can create long-term problems for the operation of state catastrophe-risk insurance markets.

Every state regulates property insurance premiums charged to homeowners and small businesses. Many states require that premiums be approved in advance by regulators. Others allow insurance regulators to review existing price schedules and empower regulators to force companies to reimburse policyholders when premiums are found to be excessive. Rate regulations can make it difficult for insurance companies to set premiums that accurately reflect available information about risks, which can exacerbate moral hazard and adverse selection problems. In some states the rate review and approval process can take many months, so insurers cannot rapidly adjust premiums when new information becomes available. The rate review process may also discourage insurance companies from proposing complex pricing plans which, though difficult to explain and justify to state rate boards, more accurately reflect detailed information about the risks associated with individual insurance policies.

Efforts by regulators to keep property insurance prices artificially low can make it difficult for individuals and businesses to obtain insurance on private markets at any price. To ensure that they will be able to pay claims after a catastrophe, private insurers need to set premiums high enough to enable them to build surplus or transfer risk to reinsurers. If regulators do not allow insurers to charge rates sufficient to accomplish these tasks, the insurers will be discouraged from taking on catastrophe risks. They may choose to sell insurance only in areas at low risk for catastrophe hazards, or they may seek to exclude coverage for such hazards under the terms of the property insurance policies they offer. Regulation can also deter insurers from competing for customers, thereby reducing the range and quality of insurance options available.

Many states that face risks from hurricanes or earthquakes have established special entities to provide insurance to those who cannot obtain coverage from private insurers. In 1996, California established a quasi-public company, the California Earthquake Authority, to sell earthquake insurance policies to California residents, backed by funds contributed by a number of private insurers operating in the state. Several states maintain residual pools to cover windstorm risks. These pools operate like traditional insurance companies, but they are required to sell policies to property owners in high-risk coastal areas and they are empowered to levy surcharges on primary insurers operating in a state.

Some state-sponsored insurance programs use complicated procedures for setting premiums, and many claim to charge premiums that are actuarially fair, but they all have one thing in common: they provide insurance only to policyholders who either will not, or cannot, obtain insurance from the

Box 5-2: Gulf Coast Property Insurance Markets After Hurricanes Katrina, Rita, and Wilma

2005 was a terrible year for communities located along the U.S. Gulf Coast. Hurricane Katrina devastated a land area the size of Great Britain and displaced more than 270,000 people. The total value of property damage and business interruption caused by Hurricane Katrina has been estimated at $135 billion. Hurricane Katrina was followed a few weeks later by Hurricane Rita, which caused an estimated $15 billion in damage, and Hurricane Wilma, which caused an estimated $20 billion in damage. The President and Congress responded by appropriating about $110 billion for disaster relief and recovery aid to affected communities. Property insurers have also played an important role in recovery efforts by paying billions of dollars of loss claims, but there are concerns that rising insurance premiums for coastal properties may be a barrier to redevelopment. The response of property insurance markets to the unprecedented losses caused by the 2005 hurricane season underscores the role of effective underwriting in managing catastrophe risks.

Hurricanes Katrina, Rita, and Wilma resulted in an estimated $57 billion in insured property damages, not including claims filed with the National Flood Insurance Program. Despite bearing enormous losses, most private-sector primary insurers operating in the Gulf Coast emerged from the 2005 hurricane season in reasonably sound financial condition. At least four primary insurers failed as a result of the 2005 storms, but the share of property and casualty insurers listed as financially impaired by a major insurance company rating agency actually dropped to a 25-year low while the aggregate value of surplus available to insurers for paying future claims increased. Primary insurers fared well as a group in part because they had transferred a significant share of their catastrophe risk exposure to reinsurers. According to one industry association, reinsurance covered about 60 percent of 2005 insured hurricane losses.

Though the U.S. property and casualty insurance sector as a whole remains healthy, property insurance markets in several coastal states are under stress. Information collected during the 2004 and 2005 hurricane seasons revealed deficiencies in industry-standard catastrophe risk models used in underwriting property insurance. These models are now being adapted to reflect expectations of more violent hurricane seasons, revised analysis of the costs of repairing property damage following major catastrophes, new findings about the effects of hurricane-generated storm surges, and other factors. As a result, primary insurers and reinsurers are increasing their estimates of probable losses on windstorm policies in areas at risk for hurricanes. A leading

catastrophe-risk modeling firm reports that revised forecasts of the severity of Atlantic hurricane seasons alone will increase estimates of loss rates from future hurricanes in the Gulf Coast and southeastern U.S. by 50 percent.

As assessments of the potential costs of future hurricanes have increased, primary insurers and reinsurers have sought to limit their exposure to windstorm hazards and increase the premiums charged for insuring this hazard. Reinsurance companies, many of whom lost capital in 2005 to hurricane-related claims, have significantly increased premiums. Unlike reinsurance premiums, premiums charged by primary insurers for homeowners' and commercial property policies are regulated by state insurance commissions. Primary insurers have petitioned state regulators to allow them to raise premiums to cover rising reinsurance costs and to more closely reflect new information on the risks posed by windstorms. Where possible, some insurers have also attempted to reduce their exposure to windstorm hazards by refusing to renew existing policies in high-risk areas or by adding conditions to policies that exclude coverage of windstorm damage. In several states, government-sponsored insurance programs that are required to provide windstorm coverage to property owners who are unable to obtain insurance through the private sector have grown dramatically.

Recent developments in coastal property insurance markets have the potential to discourage some investment in areas at high risk for hurricanes, since property owners in these areas will likely have to pay higher insurance premiums or bear greater risk than in the past. For this reason, some have argued that Federal and State governments should take action to ensure that insurance for windstorm coverage in hurricane-prone regions is widely available and that the premiums charged for this insurance are relatively low. However, as discussed in the text, efforts to keep premiums for windstorm insurance artificially low may discourage property owners from taking action to lessen future windstorm losses while potentially encouraging excessive development in high-risk areas.

private market. These programs tend to attract exactly those members whose high risk makes them unattractive to private insurers. For example, in some states, residual pools are the main providers of windstorm insurance for homeowners in coastal areas exposed to high risk from hurricanes.

In recent years a number of state-sponsored insurance programs have had difficulty paying claims following major catastrophes. Different states have dealt with this problem in different ways. A few states have used government money to provide new funds for insolvent programs, thereby passing the cost

of covering losses on to taxpayers. More commonly, states have levied surcharges on premiums for policies sold by private insurers. This approach effectively forces property owners in relatively low-risk areas who can obtain insurance from private providers to pay higher premiums to cover insured losses for property owners in higher risk areas who obtain insurance through the residual pool. By effectively raising the cost of insurance in the private market, these surcharges may actually encourage more property owners to seek insurance from the residual pool so that the pool is exposed to even higher losses the next time a catastrophe strikes.

Since people consider the cost of property insurance when deciding where to live and conduct business, the use of rate regulations or state-sponsored insurance programs to keep property insurance prices in high-risk areas artificially low can have significant negative consequences. All else equal, commercial and residential development will tend to be greater in those areas where insurance prices are lower. As a result, artificially low premiums for catastrophe risk insurance can lead to excessive development in catastrophe-prone areas, putting lives and property in harm's way.

Conclusion

All insurance markets are susceptible to problems arising from adverse selection and moral hazard, but insurers of catastrophe risks must also deal with the fact that total insured losses are difficult to predict and are potentially quite large. While it may not be possible to eliminate these problems, their effects can be moderated through prudent underwriting. Adverse selection and moral hazard problems can be lessened by being selective about which risks to insure, by setting premiums to match observable differences in risk, and by requiring policyholders to bear a share of the financial risk posed by the hazards they are insured against. Insurance providers deal with uncertain losses by charging premiums that are high enough to enable them to build surplus and/or transfer excess risk to third parties such as reinsurers.

Regulations that constrain private insurers' underwriting flexibility can undermine their ability to provide insurance coverage for catastrophe risks. Government-sponsored insurance programs that can borrow from the U.S. Treasury or levy surcharges to pay claims after a catastrophe has occurred do not face the same financial constraints as private insurers. Nonetheless, government programs that do not apply prudent underwriting standards expose taxpayers to large liabilities.

Effective insurance underwriting serves an important social function by tying the premiums and terms of insurance policies to the risks covered. When insurance prices reflect underlying economic costs they can encourage a more

efficient allocation of resources. Efforts to keep premiums for insurance against catastrophe hazards artificially low, whether through regulation or through subsidized government programs, can encourage excessively risky behavior on the part of those who might be affected by future catastrophes.